INDOOR AIR QUALITY ASSESSMENT

EOHHS Service Center
300 Howard Street
Framingham, Massachusetts

Prepared by:
Massachusetts Department of Public Health
Bureau of Environmental Health
Indoor Air Quality Program
January 2017

Background

Building:	Executive Office of Health and Human Services (EOHHS) Service Center
Address:	300 Howard Street, Framingham, MA
Assessment Requested by:	Deborah Coleman, Facilities Director, EOHHS
Reason for Request:	Concerns about allergies/health and indoor air quality (IAQ)
Date of Assessment:	January 12, 2017
Massachusetts Department of Public Health/Bureau of Environmental Health (MDPH/BEH) Staff Conducting Assessment:	Ruth Alfasso, Environmental Engineer/Inspector, IAQ Program
Date of Building Construction:	Pre-1900s
Building/Site Description:	DCF is located on the second story, of a former manufacturing plant that has been completely renovated into state offices.
Building Population:	Approximately 200 employees on two floors with members of the public visiting daily
Windows:	Openable in some areas, but generally not opened

Methods

Please refer to the IAQ Manual for methods, sampling procedures, and interpretation of results (MDPH, 2015).

IAQ Testing Results

Note that this building has been visited by the IAQ program on several occasions since the EOHHS service center occupied these offices in 2015; reports from these visits can be found on the IAQ webpage at http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-rpts/.

This visit concentrated on several areas of concern on the second floor occupied by the Department of Children and Families (DCF) and a few areas on the first floor occupied by the Department of Transitional Assistance (DTA) rather than the entire office building.

The following is a summary of indoor air testing results (Table 1).

- ***Carbon dioxide levels*** were below 800 parts per million (ppm) in all but one area assessed, indicating adequate fresh air in the space.
- ***Temperature*** was within the recommended range of 70°F to 78°F in all areas assessed.
- ***Relative humidity*** was within or close to the lower end of the recommended range of 40% to 60% in all areas assessed.
- ***Carbon monoxide*** levels were non-detectable in all indoor areas assessed.
- ***Fine particulate matter (PM2.5)*** concentrations measured were below the National Ambient Air Quality Standard (NAAQS) level of 35 $\mu g/m^3$ in all areas assessed.

Ventilation

A heating, ventilating, and air conditioning (HVAC) system has several functions. First, it provides heating and, if equipped, cooling. Second, it is a source of fresh air. Finally, an HVAC system will dilute and remove normally occurring indoor environmental pollutants by not only introducing fresh air, but also filtering the airstream and ejecting stale air to the outdoors via exhaust ventilation. Even if an HVAC system is operating as designed, point sources of respiratory irritation may exist and affect symptoms in sensitive individuals. The following analysis examines and identifies components of the HVAC system and likely sources of respiratory irritant/allergen exposure due to water damage, aerosolized dust, and/or chemicals found in the indoor environment.

Fresh air is provided by air handling units (AHUs) located on the roof. Air from the AHUs is filtered, heated/cooled, and delivered to rooms via ducted supply vents (Picture 1). Air is returned/exhausted through ducted return vents (Picture 2). It is recommended that HVAC systems be re-balanced every five years to ensure adequate air systems function (SMACNA, 1994).

Along one side of the building, sunlight could be seen streaming in through the windows (Picture 3). Adjustable blinds should be used to control solar gain within the occupied space and assist with temperature control as well as reducing glare.

Microbial/Moisture Concerns

Water-damaged and some obviously wet ceiling tiles were observed in many places on the second floor (Table 1; Pictures 1, 4 and 5). These indicate that the roof has leaked, which has been an ongoing problem since the offices were occupied. Examination of the roof revealed that parts of the roof have subsided below the level of the roof drains which allows water to pool (Picture 6) and eventually penetrate through seams or holes in the roof. Holes in the roof should be repaired as they are discovered, and consideration should be given to a more thorough repair of the roof, including slope and drains. All leaks should be reported to building management as soon as they are discovered, and water-damaged ceiling tiles should be removed and replaced. If areas have chronic leaks, temporary use of special ceiling tile inserts that can capture and direct water via a hose into a container to reduce the chance of water damage to building materials and furnishings. The containers need to be monitored and emptied at least daily.

Plants were observed in office areas (Table 1; Picture 7). Plants can be a source of pollen and mold, which can be respiratory irritants to some individuals. Plants should be properly maintained and equipped with drip pans to prevent water damage to porous materials. Plants should also be located away from air diffusers to prevent the aerosolization of dirt, pollen, and mold.

Small refrigerators and water dispensers were observed in carpeted areas (Table 1). These appliances may spill or leak and lead to carpet damage and microbial growth. It is recommended that these appliances be located in areas without carpeting or on waterproof mats; in many cases carpet squares had been replaced with tile in the area of water dispensers. Refrigerators should be kept clean to prevent odors and microbial growth.

Other IAQ Evaluations

Exposure to low levels of total volatile organic compounds (TVOCs) may produce eye, nose, throat, and/or respiratory irritation in some sensitive individuals. BEH/IAQ staff examined rooms for products containing VOCs. BEH/IAQ staff noted hand sanitizers, cleaners, air freshener products, and dry erase materials in use within the building (Pictures 8 and 9; Table 1). All of these products have the potential to be irritants to the eyes, nose, throat, and respiratory system of sensitive individuals.

Items were observed on many windowsills in the office, including some that are subject to direct sunlight (Picture 3). Items containing plastic, cardboard, or inks/paints may release odors and VOCs when heated; these items should not be placed in direct sunlight.

Cooking equipment, including toasters, microwave ovens and coffee machines were located in various parts of the office space. Food areas and cooking equipment need to be kept clean to prevent odors and pests.

Mousetraps were observed in several areas, although staff reported that rodents were not currently an issue in this office. Rodent infestation can result in indoor air quality related symptoms due to materials in their wastes. Mouse urine contains a protein that is a known sensitizer (US EPA, 1992). A sensitizer is a material that can produce symptoms (e.g., running nose or skin rashes) in sensitive individuals after repeated exposure. To eliminate exposure to allergens, rodents must be removed from the building. Please note that removal, even after cleaning, may not provide immediate relief since allergens can exist in the interior for several months after rodents are eliminated (Burge, 1995). Once the infestation is eliminated, a combination of cleaning and increased ventilation and filtration should serve to reduce allergens associated with rodents.

In some areas, stored materials and accumulated items make it more difficult for custodial staff to clean. Items for clients, such as clothing and toys, were stored in the open in some areas (Picture 10) which can allow for dusts to accumulate, create harborage for pests, or allow for hidden water damage when leaks occur. Items should be stored neatly, preferably on shelves or in closable bins, and moved periodically to allow for wet wiping and vacuuming of surfaces.

In some areas, decorative items were observed hanging from the ceiling tile system. Hanging items from the ceiling tiles can create dust and allow debris from above the tiles into occupied spaces.

Personal fans were observed in a number of areas (Table 1; Picture 11). Fan blades to some of these units had settled dust, which can be reaerosolized when the fan is activated.

The rooftop AHU for Section 4 on the second floor was opened and examined. The filter was soiled and in need of changing (Picture 11). It could not be determined at what frequency the filters were currently being changed. Filters in the AHUs should be changed no less frequently than twice a year; if filters are significantly soiled when they are changed, the frequency should

be increased. A log of when filters are changed should be kept for reference and to ensure these goals are met. Filters should be of a pleated type with a Minimum Efficiency Reporting Value (MERV) of 8 or better, and should fit flush into the AHU cabinets without gaps.

The offices were mostly carpeted. Carpets should be cleaned annually (or semi-annually in soiled/high traffic areas) in accordance with Institute of Inspection, Cleaning and Restoration Certification (IICRC) recommendations, (IICRC, 2012).

Conclusions/Recommendations

Based on observations at the time of assessment, the following is recommended:

1. Operate supply and exhaust ventilation in all areas during occupied periods.
2. Have the HVAC system balanced every 5 years in accordance with SMACNA recommendations (SMACNA, 1994).
3. Ensure filters are changed in all AHU a minimum of twice a year, more frequently if filters are significantly soiled between changes. A log should be kept of filter changes to ensure this occurs. Filters with a MERV value of 8 or higher that properly fit the AHUs should be used.
4. Use blinds to reduce solar heating and glare. Avoid storing items on windowsills that may emit odors and VOCs when heated.
5. For buildings in New England, periods of low relative humidity during the winter are often unavoidable. Therefore, scrupulous cleaning practices should be adopted to minimize common indoor air contaminants whose irritant effects can be enhanced when the relative humidity is low. To control for dusts, a high efficiency particulate arrestance (HEPA) filter equipped vacuum cleaner in conjunction with wet wiping of all surfaces is recommended. Avoid the use of feather dusters. Drinking water during the day can help ease some symptoms associated with a dry environment (throat and sinus irritations).
6. Use a reporting system to ensure that water-damaged and wet ceiling tiles and other leaks are reported promptly and removed/repaired.
7. Avoid storing materials in areas with chronic leaks. Consider the use of ceiling-tile replacements to catch leaks and drain them through a hose to a container of an appropriate volume. If used, the container must be monitored and emptied daily and kept clean to avoid odors.

8. Have the roof patched as needed. Consideration undertaking a complete overhaul of the roof including ensuring roof drains can function properly.
9. Keep indoor plants in good condition, avoid overwatering, and avoid placing them on porous items such as carpets or paper. Also, keep plants out of the air stream of supply vents.
10. Consider locating refrigerators and water dispensers in non-carpeted areas or place on a waterproof mat. Clean refrigerator spills promptly and clean refrigerators out regularly to avoid odors and microbial growth.
11. Reduce use of products containing VOCs including eliminating air freshening products.
12. Ensure cooking areas/equipment are kept clean to prevent odors and pests. Consider reducing the number of areas where food is stored and locating them away from occupied areas.
13. Use the principles of Integrated Pest Management (IPM) and the services of a licensed pest control operator to remove rodents and reduce the potential for pest infestation. Ensure that any area where rodents may have been is thoroughly cleaned to remove allergens.
14. Reduce accumulated materials on flat surfaces and move periodically to allow for thorough cleaning.
15. Store items for clients such as clothing and toys in an organized manner, preferably in closed totes or on shelves to prevent dust accumulation and reduce harborage for pests.
16. Avoid hanging items from the ceiling tiles to avoid create dust and allowing debris from above the ceiling tiles into occupied spaces.
17. Clean the blades of personal fans, supply, and exhaust vents periodically to avoid aerosolizing dusts.
18. Clean carpeting in accordance with IICRC recommendations (IICRC, 2012).
19. Refer to resource manual and other related IAQ documents located on the MDPH's website for further building-wide evaluations and advice on maintaining public buildings. These documents are available at: http://mass.gov/dph/iaq.

References

Burge, H.A. 1995. *Bioaerosols*. Lewis Publishing Company, Boca Raton, FL.

IICRC. 2012. Institute of Inspection, Cleaning and Restoration Certification. Carpet Cleaning: FAQ. Retrieved from http://www.iicrc.org/consumers/care/carpet-cleaning.

MDPH. 2015. Massachusetts Department of Public Health. Indoor Air Quality Manual: Chapters I-III. Available at: http://www.mass.gov/eohhs/gov/departments/dph/programs/environmental-health/exposure-topics/iaq/iaq-manual/.

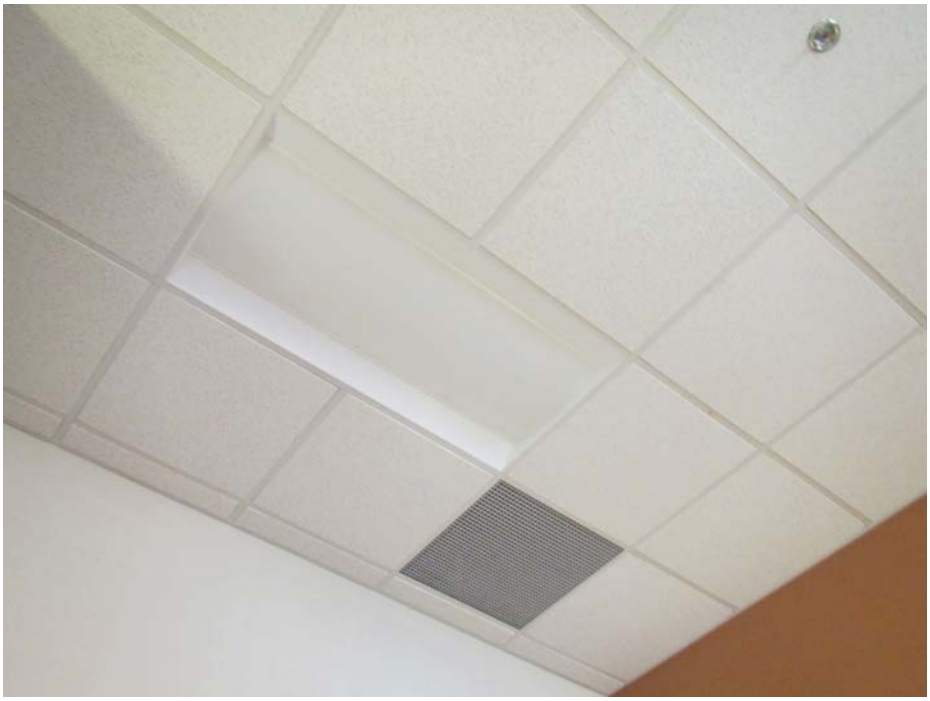
SMACNA. 1994. HVAC Systems Commissioning Manual. 1st ed. Sheet Metal and Air Conditioning Contractors' National Association, Inc., Chantilly, VA.

US EPA. 1992. Indoor Biological Pollutants. US Environmental Protection Agency, Environmental Criteria and Assessment Office, Office of Health and Environmental Assessment, research Triangle Park, NC. EPA 600/8-91/202. January 1992.

Picture 1

Supply vent, note water-damaged ceiling tiles

Picture 2



Return vent

Picture 3

Sunlight through window, note plastic items on windowsill

Picture 4

Wet, bulging ceiling tile

Picture 5

Water-damaged and missing ceiling tiles

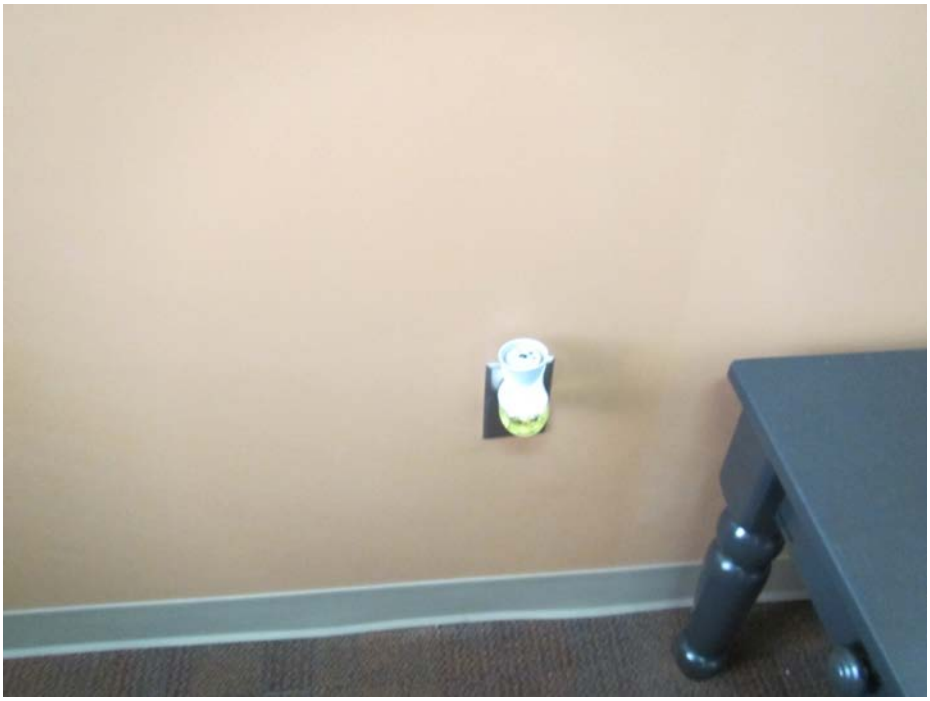
Picture 6

Water pooling on the roof due to poor slope to roof drains

Picture 7

Plants on a windowsill

Picture 8



Plug-in air freshener

Picture 9

Air freshener/cleaner

Picture 10

Toys stored on the floor in piles

Picture 11

Soiled AHU filter

Picture 12

Dusty personal fan

Location: EOHHS Center **Indoor Air Results**

Address: 300 Howard Street, Framingham, MA **Table 1** **Date: 1/12/2017**

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 ($\mu g/m^3$)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
Background	362	1.0	62	55	13					Warm and humid
Second Floor, DCF areas										
Kitchen	702	ND	70	51	6	1	Y	N	Y	Refrigerator, toaster, microwave, NC
Half wall office next to kitchen	676	ND	70	45	7	2	N	Y	Y	
2311 cubes	880	ND	70	46	7	1	N	Y	Y	
2297 half wall office	730	ND	70	45	6	1	N	Y	Y	
2309	646	ND	71	45	6	2	N	Y	Y	
Half wall office	692	ND	71	44	7	1	N	Y	Y	
2306	700	ND	71	44	6	2	N	Y	Y	
2294 half wall office	800	ND	72	43	6	1	N	Y	Y	

ppm = parts per million
$\mu g/m^3$ = micrograms per cubic meter
ND = non detect
AF = air freshener
AI – accumulated items
CP = cleaning products
CT = ceiling tile
DEM = dry erase materials
DO = door open
HS = hand sanitizer
NC = non-carpeted
PC = photocopier
PF = personal fan
WC = water cooler
WD = water-damaged

Comfort Guidelines

Carbon Dioxide: < 800 ppm = preferred
> 800 ppm = indicative of ventilation problems

Temperature: 70 - 78 °F
Relative Humidity: 40 - 60%

Location: EOHHS Center **Indoor Air Results**

Address: 300 Howard Street, Framingham, MA **Date: 1/12/2017**

Table 1 (continued)

Location	Carbon Dioxide (ppm)	Carbon Monoxide (ppm)	Temp (°F)	Relative Humidity (%)	PM2.5 ($\mu g/m^3$)	Occupants in Room	Windows Openable	Ventilation		Remarks
								Supply	Exhaust	
2304	668	ND	72	43	5	1	N	Y	Y	Plants
2293 half wall office	621	ND	73	41	4	0	N	Y	Y	PF, HS
2303 cubes	714	ND	73	41	4	0	N	Y	Y	PC in hall
2204 office	633	ND	73	40	7	0	N	Y	Y	DO, PF, HS
2203 office	568	ND	71	40	7	0	N	Y	Y	DEM
2315 cubes	515	ND	72	41	7	1	N	Y	Y	
2202 office	601	ND	72	40	6	0	N	Y	Y	
2261 cubes	646	ND	72	43	3	3	N	Y	Y	PF, heater, CP/AF, HS
2269-2272 cubes	642	ND	72	41	7	1	N	Y	Y	AI, WD CT (reported previous week), decorative items
2276 cubes	626	ND	73	41	7	2	N	Y	Y	WD CT (2)

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								Supply	Exhaust	
2281 cubes	626	ND	73	40	7	3	N	Y	Y	Sunlight, decorative items, WD CT, HS
3386 cubes	625	ND	73	40	8	2	N	Y	Y	WD CT
Goldman half-wall office	685	ND	74	40	8	1	N	Y	Y	WD carpet in hall (old stain)
Ramos half-wall office	670	ND	74	40	7	0	N	Y	Y	Food
2302 half wall office	681	ND	74	39	7	0	N	Y	Y	PF
2292 cubes	647	ND	74	40	7	1	N	Y	Y	Plant
2213 storage							N	Y		NC, storage items, WD CT (no items underneath)
2206 janitor closet							N	Y	N	NC, no exhaust, CP, mops
2212 (IT)							N	Y	N	Computers
Storage							N	Y	Y	Boxes on floor

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								Supply	Exhaust	
Women's restroom								Y	Y	Exhaust is small, dusty, operating
Men's Restroom								Y	Y	Exhaust is small, operating
Second floor, Section 5										
2221 files										WD and missing CT, NC
2220 kitchen	493	ND	72	39	7	0	N	Y	Y	NC, WD CT, toaster and fridge, vending had leaked in the past
Cubes next to kitchen	603	ND	74	38	7	3	N	Y	Y	Clothing and items
2222 office	522	ND	74	36	8	0	N	Y	Y	Plant, coffee
2223 office	549	ND	73	36	7	0	N	Y	Y	Heater
2225	540	ND	73	37	10	0	N	Y	Y	4 WD CT, water stain on wall
2226	508	ND	73	36	7	0	N	Y	Y	WD CT, fridge on carpet, HS

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								Supply	Exhaust	
2227 office	495	ND	74	37	8	0	N	Y	Y	Plug-in AF
2228 office	506	ND	73	38	7	0	N	Y	Y	AI on floor
2230 office	550	ND	73	38	7	3	N	Y	Y	DEM, plants, fridge on carpet
2231 office	647	ND	73	38	7	0	N	Y	Y	Coffee
Open storage area								Y	Y	Messy, clothes and items stored openly
2345 cubes	528	ND	73	38	7	1	N	Y	Y	
2340 cubes	527	ND	73	37	7	2	N	Y	Y	Plants, toys
Cubes	517	ND	73	37	7	2	N	Y	Y	Decorations
2353 cube	552	ND	74	39	8	1	N	Y	Y	DEM, items on windowsill, HS
Stairwell										Odor in stairwell, handle warm to the touch

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								Supply	Exhaust	
2360 cube	556	ND	74	39	7	2	N	Y	Y	DEM, food
cubes	562	ND	74	39	7	9	N	Y	Y	WD CT, sunlight, plants and items on windowsill
2279 cubes	555	ND	74	39	7	1	N	Y	Y	
Cubes	561	ND	75	39	8	3	N	Y	Y	DEM, CP
2223	595	ND	75	39	7	0	N	Y	Y	
2251 kitchen	528	ND	75	38	7	0	N	Y	Y	NC, fridge and microwave
2396	621	ND	75	37	7	4	N	Y	Y	Items on windowsill
Cubes	645	ND	75	35	7	2	N	Y	Y	CP, clothing
2415	680	ND	75	35	7	1	N	Y	Y	Items hanging from ceiling, PF, HS
2259 office	642	ND	75	35	7	0	N	Y	Y	Food, plants, PF

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								Supply	Exhaust	
2254	652	ND	74	35	7	0	N	Y	Y	Upholstered items
2255 conference	657	ND	74	36	7	0	N	Y	Y	Old vault boarded up, no wallboard, reports of drafts
2257 office	717	ND	74	36	7	0	N	Y	N	DO
2401 cubes	705	ND	74	36	7	5	n	y	y	Plants
First Floor DTA areas										
1152 and area	747	ND	74	34	6	0	N	Y	Y	Area of leak one year ago, wallboard all replaced 12-18 inches above ground
1154 office	695	ND	74	33	6	0	N	Y	Y	Plants, HS, PF
1157 office	751	ND	74	34	6	1	N	Y	N	
Cube area	669	ND	74	32	6	2	N	Y	Y	HS, DEM

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